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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— of inventorship (Rule 4.17(iv)) for US only

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2004/033551 A3

(54) Title: COMPATIBILIZED THERMOPLASTIC VULCANIZATE BLENDS AND THEIR MORPHOLOGY AS DETERMINED BY ATOMIC FORCE MICROSCOPY

(57) Abstract: Thermoplastic Vulcanizate (TPV) blends are disclosed wherein the otherwise generally compatible blend of thermoplastic and crosslinked elastomer is made unexpectedly more compatible on the nano-scale, as evaluated Atomic Force Microscopy (AFM). The blends comprise a polyolefin matrix, domains of well-dispersed crosslinked olefinic rubber particles and the presence between the rubber particles of ligaments of a compatibilizing copolymer comprising olefin monomeric units and aromatic monomeric units. The addition of the compatibilizer increased the dispersion of olefinic rubber particles.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/03/31764

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 C08L23/12 C08L23/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|---|-----------------------|
| X | US 6 100 334 A (ABDOU-SABET SABET) 8 August 2000 (2000-08-08) claims 1,11 tables II-IV | 1-9 |
| X | ----- US 5 783 629 A (SRINIVASAN SACHIT ET AL) 21 July 1998 (1998-07-21) claim 1; examples 4,25-27 | 1-4,6 |
| X | ----- US 2002/107328 A1 (PARIKH DEEPAK R ET AL) 8 August 2002 (2002-08-08) page 4, paragraph 46; claim 1 | 1 |
| A | ----- EP 0 857 761 A (YOKOHAMA RUBBER CO LTD) 12 August 1998 (1998-08-12) page 8, line 22 - line 35 page 27, line 5 - line 36 | 1-9 |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Ir [REDACTED] application No.
PCT/US 03/31764

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
 No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/ US 03/31764

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

2. claim: 10

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Search Report Application No
PC/ [REDACTED] 3/31764

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
|--|----|------------------|-------------------------|-------------|------------------|
| US 6100334 | A | 08-08-2000 | NONE | | |
| US 5783629 | A | 21-07-1998 | US | 5498671 A | 12-03-1996 |
| | | | US | 5693710 A | 02-12-1997 |
| | | | US | 5686529 A | 11-11-1997 |
| | | | AT | 200909 T | 15-05-2001 |
| | | | CA | 2155543 A1 | 18-08-1994 |
| | | | DE | 69427163 D1 | 07-06-2001 |
| | | | DE | 69427163 T2 | 15-11-2001 |
| | | | EP | 0683727 A1 | 29-11-1995 |
| | | | JP | 3297048 B2 | 02-07-2002 |
| | | | JP | 8506842 T | 23-07-1996 |
| | | | MX | 9401084 A1 | 31-08-1994 |
| | | | WO | 9418001 A1 | 18-08-1994 |
| US 2002107328 | A1 | 08-08-2002 | NONE | | |
| EP 0857761 | A | 12-08-1998 | JP | 9316344 A | 09-12-1997 |
| | | | JP | 9314752 A | 09-12-1997 |
| | | | JP | 3098191 B2 | 16-10-2000 |
| | | | JP | 10016137 A | 20-01-1998 |
| | | | JP | 10025375 A | 27-01-1998 |
| | | | JP | 10036571 A | 10-02-1998 |
| | | | EP | 0857761 A1 | 12-08-1998 |
| | | | KR | 272125 B1 | 15-11-2000 |
| | | | US | 6062283 A | 16-05-2000 |
| | | | WO | 9745489 A1 | 04-12-1997 |
| | | | US | 6397912 B1 | 04-06-2002 |
| | | | DE | 19681101 T0 | 05-02-1998 |
| | | | WO | 9716485 A1 | 09-05-1997 |
| | | | US | 5910544 A | 08-06-1999 |
| | | | JP | 3138861 B2 | 26-02-2001 |
| | | | JP | 10086605 A | 07-04-1998 |
| | | | JP | 3159941 B2 | 23-04-2001 |
| | | | JP | 10114840 A | 06-05-1998 |